

perfect of these patches. The soil is a sandy loam upon the greensand, and the crop is vigorous, with strong stems, and I could not trace locally any circumstances accounting for the peculiar forms of the patches in the field, nor indicating whether it was wind or rain, or both combined, which had caused them, beyond the general evidence everywhere of heavy rainfall. They were to me suggestive of some cyclonic wind action, and may perhaps have been noticed elsewhere by some of your readers.

Guildown, Guildford, July 23

J. RAND CAPRON

### The Inevitable Test for Aurora

I HAVE not long returned from abroad, and have only recently had the opportunity of perusing in *NATURE* (vol. xxii. pp. 76, 96, 145) the correspondence of Messrs. De La Rue and Müller, Prof. Piazzzi Smyth, and Mr. Backhouse on this subject.

I do not understand Messrs. De La Rue and Müller as claiming their electric discharges to be in the nature of an actual auroral discharge, but rather that their experiments inform us inductively at what heights auroræ are to be found. This, however, doubtless assumes that the discharges in question and auroræ must have something very much in common; and Prof. Piazzzi Smyth is quite to the point in remarking that unless the citron line (and, I would add, the red line) are present in the spectrum, the identity of the discharges with the aurora has not even a foundation.

The fact is, that many of the electric discharges in air and the air gases, and the circumstances attending them—we may instance the ordinary tube glow, its change from rose-tint to violet under magnetic influence, the aura-arc accompanying the spark discharge under similar conditions, the dark space between the terminal and the glow, the change of colours in a hydrogen tube, and other appearances which I have not time to capitulate—so closely resemble auroral incidents, that one is quite disappointed to find on examination no concordance in the spectra. At the most, in a vague and unsatisfactory way one or two of the blue and violet lines in the aurora spectrum have been assigned to one or other of the atmospheric gases; but as Prof. Smyth points out, the red and green giant lines of the spectrum have up to the present time found no terrestrial analogues. I have examined the air spectrum and the spectra of the component gases of air under many various conditions, but always without success so far as these lines are concerned.

I have not, however, had the opportunity of doing this in the case of direct discharges from large secondary batteries; and it would undoubtedly be a valuable addition to our knowledge of facts relating to auroræ if Messrs. De La Rue and Müller would undertake this examination, and clear up matters in that respect. With regard to the heights at which auroræ obtain, the evidence is very conflicting. Certainly they have been seen very near the earth ("Auroræ, their Characters and Spectra," pp. 37 to 40. Height of the Aurora). It is unfortunate that simultaneous observations of the auroral corona are almost entirely wanting. I think I once saw one in print, but missed it subsequently, and would be glad if any particulars could now be furnished me. Prof. Newton, by calculations based on observations of auroral arches in 28 auroræ, has assigned a height of from 33 to 281 miles, with a mean of 130 miles.

Messrs. De la Rue and Müller, I notice, deduce experimentally that at 124 miles no discharge could occur. As to whether the red or the white aurora is the nearest to the earth, my impression certainly is that the apparently low-lying auroræ have generally been the white. I may instance the aurora seen by Mr. Ladd a Margate, "a white ray," and that seen by me in the Isle of Skye in September, 1874. In Lapland, too, the auroræ seem almost universally yellow, but it can hardly be assumed that they are all thirty-seven miles high. The apparently lower position of the red tint is by no means universal, and can hardly be relied upon as evidence on the point, especially when so many auroræ are seen in which it is wanting. I have great hopes, with a spectrocope specially prepared for the purpose, of getting the photographed spectrum of an aurora.

The red line is of course out of the question, but judging from experiments on gas tubes I think the green might be got, and the blue and violet I make in anticipation pretty sure of in the event of an aurora lasting some hours. The principle of the instrument is a long collimator, a single fluid prism, and a short focus-projecting lens, used with rapid dry plates.

Guildown, Guildford, July 23

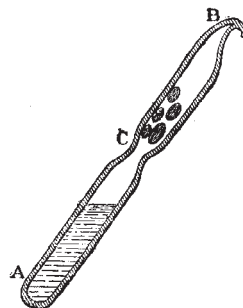
J. RAND CAPRON

### Experiment with Glass Tubes

I HAVE just been repeating a very beautiful experiment of Prof. Quincke's which he showed me some weeks ago in his laboratory at Heidelberg. The experiment was, I believe, described in *Poggendorff* about two years ago, but I have not seen it noticed in English papers, and a few words about it may interest your readers.

Prof. Quincke, with a view to test the porosity of glass for gases, sealed up tubes in which hydrogen and carbonic acid were generated in great quantity, and weighed them from time to time. Up to the present time, as I learned from him, no loss of weight has been detected. He obtained, however, a very curious result. As I do not know precisely how Prof. Quincke filled his tubes, let me describe what I did myself three weeks ago, remarking that I have done nothing but attempt to repeat what he showed me in Heidelberg.

I took a glass tube, A B, about 5 inches long and  $\frac{1}{4}$  inch in external diameter, with good stout walls. I closed the end A, and let the glass fall in at C, keeping it still very strong, and annealing very carefully at A and C. I introduced some sulphuric acid into the part CA, carefully keeping the neck C dry, and dropped into the part B C some fragments of marble, previously washed, in order that no little particles should tumble down through the neck, C, and commence effervescing before I was ready. I then drew out the tube at B, making a small hook, by which the tube can be suspended if necessary, closed it very strongly, and annealed the extremity carefully, wrapped the tube in cotton wool, and inverted it. The sulphuric acid attacked the marble, and carbonic acid was given off no doubt in great quantity.



For the first few days there was nothing particular to be noticed. The tube was filled with a bubbling mass of liquid and white mud. Latterly, however, it has begun to show the phenomena which Prof. Quincke observed. The liquid now no longer wets the glass as it did at first, but creeps away from it, giving very much the appearance of the "tears of strong wine." Day by day this is getting more marked, and I expect that soon, as was the case in the Heidelberg tubes, the acid will roll about in the tube like so much quicksilver. Meantime it is most interesting to watch.

I believe Prof. Quincke considers that a thick layer of gas is condensed over the surface of the glass, and that it is this which gives rise to the very peculiar capillary phenomena that present themselves.

I feel bound to remark that the experiment is one that ought not to be attempted without great care and caution.

J. T. BOTTOMLEY

Physical Laboratory, University of Glasgow, July 15

### On the Colours of Double Stars

If any light whatever has its intensity increased the effect on the eye is to add to the sensation a certain yellow element which I have accurately defined by experiment (*Am. Jour. Sci.*, April, 1877, vol. xiii. p. 247). A red light brightened becomes yellower, a green light yellower, a yellowish white less white, a blue or violet light whiter. The phenomena are described at length in Prof. Rood's "Modern Chromatics." The fact that an incandescent body becomes less red and more yellow when it is heated is probably due to this physiological principle. That the incandescent body ultimately becomes white is probably owing to some not understood modification of the principle for excessively bright lights.

It follows that if two stars are of unequal brightness they will appear of different colours unless the qualities of the two lights have a peculiar relation to one another; and the brighter star will usually be the yellower. Accordingly, if we refer to Mr. Burnham's lists of binaries recently published by Prof. Holden (*Am. Jour. Sci.*, June, 1880, vol. xix. p. 467) we find that although differences of colour are so little distinguished that three-quarters of all the pairs are considered to be of the same colour, yet of the twenty-four pairs which differ in brightness by two magnitudes

or over, not one is considered to have components of the same colour. And of the forty-two pairs which are said to be of different colour all but two have more yellow in the brighter, so much so indeed that it is possible to suppose that the difference of brightness is the chief cause of the difference of colour. The two exceptions are :—

No. 23. *ε Boëtis* A. eq. Cærulea B. eq. Cærulea  
No. 42. *O 507* A. Blanche B. Cendriolivatre

There is evidently some error about No. 23. Either the colours are wrong, or it is wrongly stated to have differently-coloured components. In No. 42 it is difficult to say which component is more yellow. Although, then, it is certain that other causes largely affect the colours of stars, yet differences of brightness seem to have the greatest effect in producing the apparent differences in the colours of double-stars.

Prof. Holden compares the colours of bright and faint stars to those of a more or less hot incandescent body. But in the latter case the dimmer light is accompanied with redness. We know that this is not the case with the light of our own sun; for of a white surface, upon part of which the sun shines, while the rest is in shadow, the darker part is bluer. In the same way, of the forty binaries of which the brighter component is the yellower, there are thirty-seven in which the fainter is bluer, and only three in which it is distinctly redder. It appears, therefore, that most double-stars do not differ greatly in colour from our sun, and do not shine with the strongly red light of an incandescent solid.

C. S. PEIRCE

Paris, July 20

#### Coffee-Disease in New Granada

THE following information about what appears to be a new disease of the coffee-tree is taken from an official letter written on April 29 last by Mr. C. Michelsen, Commissioner of Agriculture at Bogotá, to Mr. José Herrera, Vice-consul of New Granada in this city, who sent me a copy of it, requesting me to give him my opinion about the disease.

At first there appear on the leaves small spots of a light-greenish colour, which in two or three days turn brownish, and then appears on each of them a fungus *divided in three or more greenish-yellow branches*. This fungus is said to be phosphorescent at night, and *in places where it is very common a phosphoric smell is noted* (!) After some days the diseased leaves fall off; the fruits, which also are attacked by the parasite, follow very soon, and the trees are left quite bare. They form, however, new leaves after some months, but these are again attacked by the fungus.

The disease is reported to be more frequent in damp places than in dry ones, its ravages being greatest in plantations where the trees are planted rather close. The fungus has also attacked the shade trees, especially the *guamos* (*Inga* sp.).

Though the description is far from being satisfactory, I think it is pretty clear that the fungus is not the *Hemileia vastatrix* of Ceylonese celebrity. However it bears a great resemblance to it, so that I recommended to employ fumigations with sulphur under the kind of large umbrella proposed by Mr. George Wall (*NATURE*, vol. xix. p. 423). The unusually rainy weather in the last year has very likely much to do with the spread of the disease, which at the same time is a new proof of the eminently fatal consequences resulting from close planting.

I have asked for dried specimens of diseased leaves, in order to submit them for examination to a competent mycologist.

Caracas, June 26

A. ERNST

#### Toughened Glass

PROBABLY the accident mentioned by Mr. Noble Taylor is not exceptional, as a similar one happened to a member of my own family. She was about to take a seidlitz-powder, and had poured the contents of the blue paper into a tumbler of toughened glass half filled with cold water, and was stirring it gently to make the powder dissolve, when the tumbler flew into pieces with a sharp report. There was no fire or lamp in the room at the time. Some of the fragments flew to a distance of three or four feet. The bottom of the tumbler was not altogether fractured, but cracked into a number of little squares, which could be separated readily.

T. B. SPRAGUE

Edinburgh, July 20

THE same accident occurred to me a few nights ago as happened to your correspondent, and I cannot help thinking that the spoon had most to do with the phenomenon.

In a hot room I had just finished what is usually called a "lemon squash," i.e., the juice of a lemon and a little white sugar, with a bottle of soda-water, a lump of ice being put into the mixture. I was talking at the time, and so held the empty glass with a spoon in it in my hand for a second or two, when suddenly it went off in my hand into thousands of pieces, none larger than an inch or so.

I picked up one of the largest and thickest pieces, and found it to be so thoroughly disintegrated that I broke it up with my fingers into about a hundred small pieces, and might have done more. This disintegration seems to be a natural property of toughened glass when broken, but I never before saw a case of its breaking up without being struck. I do not think that usually such occurrences are dangerous, on account of the entire destruction of the fabric.

J. C. J.

#### Large Hailstones

ON Tuesday, July 13, at 2.30 p.m., hail began to fall heavily in this neighbourhood. A thunderstorm was at the time approaching rapidly from the north-east. I was struck with the extraordinary size of the stones, and going into the open air I collected six—the first that came to hand—in an accurately-tared glass, and weighed rapidly. The six stones weighed 5'766 grams. The average weight for each stone was therefore '961 gram, or 14'8 grains. A pane of glass in a skylight window had a hole driven through it by one hail-stone.

GEORGE PATERSON

Borax Works, Old Swan, Liverpool, July 14

CHATEL, JERSEY.—Please send exact address.

#### PAUL BROCA

THE sudden death of the eminent French anthropologist, Dr. Paul Broca, which we announced a fortnight since, is an irreparable loss to science, and for the French medical and anthropological schools particularly.

Prof. Broca, born in 1824 at Ste. Foy la Grande (Gironde), was a senator, vice-president of the Academy of Medicine, officer of the Legion of Honour, and member of several learned societies. Since 1846, the year in which he was promoted Aide d'anatomie, till 1880, when he died as a professor of surgery, during nearly thirty-four years the life of Dr. Broca has been an uninterrupted consecration to science. A rapid review of his scientific work, especially of what he did for anthropology, will show how indefatigable was his zeal, how well his life has been spent.

Broca's publications on various subjects in anatomy, surgery, and anthropology are innumerable, especially his contributions to the last-mentioned subject. One has only to open the numerous volumes of the *Bulletins* of the Paris Anthropological Society, of the *Mémoires* and the *Revue d'Anthropologie* and other scientific journals, to get an idea of Broca's immense activity. In 1856 he published his famous "Traité des Anéurismes," which, with his "Traité des Tumeurs," published in 1866, constitute his principal medical works. The former opened a new era in the treatment of these affections; in the latter Broca expounded the historical evolution of the knowledge of tumours and their treatment in so able a manner that it has hitherto not been surpassed.

In 1861 Broca made his remarkable discovery of the seat of articulate language at the third frontal convolution of the left side of the brain. Moreover in later years Broca devoted himself to the study of the brains of man and animals, greatly contributing to our knowledge on that subject. The *Revue d'Anthropologie* contains many of the results of these studies; for instance, "Sur la Topographie cranio-cérébrale," "Étude sur le Cerveau du Gorille," "Anatomie comparée des Circonvolutions cérébrales," "Localisations cérébrales," &c.